Patent Claims

1. Method for establishing a light beam (CLB) with substantially constant luminous intensity comprising the steps of

- establishing a light beam (LB) by means of a light source (SAL) and

- controlling an attenuation of said light beam (LB) on the basis of occurrences of luminous intensity peaks (IP) in said light beam (LB).

2. Method for establishing a light beam according to claim 1 whereby said luminous intensity peaks (IP) occur periodically.

3. Method for establishing a light beam according to claim 1 or claim 2 whereby said luminous intensity peaks (IP) may at least within a particular time interval be considered of substantially equal magnitude.

4. Method for establishing a light beam according to any of the claims 1 to 3 whereby said particular time interval is 50 hours, more preferably 200 hours and even more preferably 1000 hours.

5. Method for establishing a light beam according to any of the claims 1 to 4 whereby said controlling an attenuation comprises applying a first level of attenuation to said light beam (LB) at times where the luminous intensity of said light beam assumes the magnitude of an intensity floor (IF) and applying a further level of attenuation to the said light beam at times where luminous intensity peaks (IP) occur.

6. Method for establishing a light beam according to any of the claims 1 to 5 whereby said further level of attenuation is proportioned to the magnitude difference between said luminous intensity peaks (IP) and said luminous intensity floor (IF).

7. Method for establishing a light beam according to any of the claims 1 to 6 whereby said attenuation is achieved by means of a variable attenuation means (VAM).

8. Method for establishing a light beam according to any of the claims 1 to 7 whereby said variable attenuation means (VAM) is capable of applying at least two different levels of attenuation to said light beam (LB).

9. Method for establishing a light beam according to any of the claims 1 to 8 whereby one of said at least two different levels of attenuation represents substantially no attenuation.

10. Method for establishing a light beam according to any of the claims 1 to 9 whereby an attenuation control means (ACM) is coupled to said variable attenuation means (VAM).

11. Method for establishing a light beam according to any of the claims 1 to 10 whereby said attenuation control means (ACM) controls which of said at least two different levels of attenuation that is applied to said light beam (LB) by means of an attenuation control signal (ACS).

12. Method for establishing a light beam according to any of the claims 1 to 11 whereby said attenuation control means (ACM) is coupled to a lamp driver (LD) that drives said light source (SAL).

13. Method for establishing a light beam according to any of the claims 1 to 12 whereby said attenuation control means (ACM) controls the timing of said luminous intensity peaks (IP) by means of a lamp driver control signal (LCS).

14. Method for establishing a light beam according to any of the claims 1 to 13 whereby said attenuation control means (ACM) controls the magnitude of said luminous intensity peaks (IP) by means of a lamp driver control signal (LCS).

15. Method for establishing a light beam according to any of the claims 1 to 14 whereby said attenuation control means (ACM) receives a lamp driver reference signal (LRS) comprising information on properties of said luminous intensity peaks (IP).

16. Method for establishing a light beam according to any of the claims 1 to 15 whereby said attenuation control means (ACM) controls which of said at least two different levels of attenuation that is applied to said light beam (LB) by means of said attenuation control signal (ACS) at least partly on the basis of said lamp driver reference signal (LRS).

17. Method for establishing a light beam according to any of the claims 1 to 16 whereby said attenuation control means (ACM) receives an attenuation reference signal (ARS) comprising information on properties of said variable attenuation means (VAM).

18. Method for establishing a light beam according to any of the claims 1 to 17 whereby said attenuation control means (ACM) controls properties of said luminous intensity peaks (IP) by means of said lamp driver control signal (LCS) at least partly on the basis of said attenuation reference signal (ARS).

19. Method for establishing a light beam according to any of the claims 1 to 18 whereby said attenuation control means (ACM) receives a light beam reference signal (BRS) derived from an intensity measuring device (BIM) adapted to measure the intensity of the light beam (LB).

20. Method for establishing a light beam according to any of the claims 1 to 19 whereby said attenuation control means (ACM) receives a constant light beam

reference signal (CRS) derived from an intensity measuring device (CIM) adapted to measure the intensity of said substantially constant intensity light beam (CLB).

21. Method for establishing a light beam according to any of the claims 1 to 20 whereby said attenuation control means (ACM) controls properties of said luminous intensity peaks (IP) by means of said lamp driver control signal (LCS) at least partly on the basis of said light beam reference signal (BRS), said constant light beam reference signal (CRS) or a combination thereof.

22. Method for establishing a light beam according to any of the claims 1 to 21 whereby said attenuation control means (ACM) controls which of said at least two different levels of attenuation that is applied to said light beam (LB) by means of said attenuation control signal (ACS) at least partly on the basis of said light beam reference signal (BRS), said constant light beam reference signal (CRS) or a combination thereof.

23. Method for establishing a light beam according to any of the claims 1 to 22 whereby said attenuation control means (ACM) controls said variable attenuation means (VAM), said lamp driver (LD) or both at least partly on the basis of predefined settings.

24. Method for establishing a light beam according to any of the claims 1 to 23 whereby said attenuation control means (ACM) continuously controls said variable attenuation means (VAM), said lamp driver (LD), or both.

25. Method for establishing a light beam according to any of the claims 1 to 24 whereby said attenuation control means (ACM) establishes a synchronization between the timing of the application of said first and further levels of attenuation and the timing of said luminous intensity peaks (IP).

26. Method for establishing a light beam according to any of the claims 1 to 25 whereby said variable attenuation means (VAM) is a multilevel variable attenuation means (MVAM).

27. Method for establishing a light beam according to any of the claims 1 to 26 whereby said multilevel variable attenuation means (MVAM) is capable of applying infinite levels of attenuation to said light beam (LB).

28. Method for establishing a light beam according to any of the claims 1 to 27 whereby said attenuation control means (ACM) controls which of said infinite levels of attenuation that said multilevel variable attenuation means (MVAM) applies to the light beam (LB) at least partly on the basis of the magnitude difference between of the intensity peaks (IP) and the intensity floor (IF).

29. Method for establishing a light beam according to any of the claims 1 to 28 whereby said attenuation control means (ACM) regulates which of said infinite levels of attenuation that said multilevel variable attenuation means (MVAM) applies to the light beam (LB) at least partly on the basis of feedback from a constant light beam intensity measuring device (CIM).

30. Method for establishing a light beam according to any of the claims 1 to 29 whereby said attenuation control means (ACM) controls which of said infinite levels of attenuation that said multilevel variable attenuation means (MVAM) applies to the light beam (LB) at least partly on the basis of user input.

31. Method for establishing a light beam according to any of the claims 1 to 30 whereby said attenuation control means (ACM) controls which of said infinite levels of attenuation that said multilevel variable attenuation means (MVAM) applies to the light beam (LB) at least partly on the basis of said lamp driver reference signal (LRS).

32. Method for establishing a light beam according to any of the claims 1 to 31 whereby said attenuation control means (ACM) controls which of said infinite levels of attenuation that said multilevel variable attenuation means (MVAM) applies to the light beam (LB) at least partly on the basis of the elapsed time of light source usage.

33. Method for establishing a light beam according to any of the claims 1 to 32 whereby said attenuation control means (ACM) promotes compensation for light beam property changes caused by prolonged use of said light source (SAL).

34. Method for establishing a light beam according to any of the claims 1 to 33 whereby said light beam property changes comprises intensity peak (IP) magnitude changes.

35. Method for establishing a light beam according to any of the claims 1 to 34 whereby said variable attenuation means (VAM) comprises a wheel (W) rotating around a centre of rotation (COR), said centre of rotation being displaced from the centre of a cross-section of said light beam (LB) in a direction perpendicular to the direction of said light beam, at least by a distance corresponding to the radius of said cross-section.

36. Method for establishing a light beam according to any of the claims 1 to 35 whereby said wheel (W) comprises at least one transparent section (TS).

37. Method for establishing a light beam according to any of the claims 1 to 36 whereby said wheel (W) comprises at least one cutout section (CS).

38. Method for establishing a light beam according to any of the claims 1 to 37 whereby said wheel (W) comprises at least one semitransparent shaded section (SS).

39. Method for establishing a light beam according to any of the claims 1 to 38 whereby said wheel (W) comprises at least one semitransparent raster section (RS).

40. Method for establishing a light beam according to any of the claims 1 to 39 whereby said wheel (W) comprises at least one perforated section (PS).

41. Method for establishing a light beam according to any of the claims 1 to 40 whereby said rotation of said wheel (W) is at least partly controlled by said attenuation control means (ACM).

42. Method for establishing a light beam according to any of the claims 1 to 41 whereby said wheel (W) comprises several semitransparent sections (SS1, SS2, SS3) each having different opacity.

43. Method for establishing a light beam according to any of the claims 1 to 42 whereby said wheel (W) is displaceable in a direction perpendicular to the direction of said light beam (LB) by a user.

44. Method for establishing a light beam according to any of the claims 1 to 43 whereby said wheel (W) is displaceable in a direction perpendicular to the direction of said light beam (LB) at least partly under control from said attenuation control means (ACM).

45. Method for establishing a light beam according to any of the claims 1 to 44 whereby said variable attenuation means (VAM) comprises a diaphragm (DP) establishing an aperture AP of variable size.

46. Method for establishing a light beam according to any of the claims 1 to 45 whereby said size of said aperture AP is at least partly controlled by said attenuation control means (ACM).

47. Method for establishing a light beam according to any of the claims 1 to 46 whereby said variable attenuation means (VAM) comprises an opaque plate (OP) and mounting means (AR) allowing said opaque plate in a variable degree to obstruct said light beam.

48. Method for establishing a light beam according to any of the claims 1 to 47 whereby said degree of obstruction is at least partly controlled by said attenuation control means (ACM).

49. Method for establishing a light beam according to any of the claims 1 to 48 whereby said variable attenuation means (VAM) comprises a displaceable sheet (SH), said displacement being allowed in a plane perpendicular to the direction of said light beam (LB).

50. Method for establishing a light beam according to any of the claims 1 to 49 whereby said sheet (SH) comprises at least one transparent section (TS).

51. Method for establishing a light beam according to any of the claims 1 to 50 whereby said sheet (SH) comprises at least one cutout section (CS).

52. Method for establishing a light beam according to any of the claims 1 to 51 whereby said sheet (SH) comprises at least one semitransparent shaded section (SS).

53. Method for establishing a light beam according to any of the claims 1 to 52 whereby said sheet (SH) comprises at least one semitransparent raster section (RS).

54. Method for establishing a light beam according to any of the claims 1 to 53 whereby said sheet (SH) comprises at least one perforated section (PS).

55. Method for establishing a light beam according to any of the claims 1 to 54 whereby said sheet (SH) comprises several semitransparent sections (SS1, SS2, SS3) each having different opacity.

56. Method for establishing a light beam according to any of the claims 1 to 55 whereby said displacement of said sheet (SH) is at least partly controlled by said attenuation control means (ACM).

57. Method for establishing a light beam according to any of the claims 1 to 56 whereby said displacement of said sheet (SH) is at least partly controlled by a user.

58. Method for establishing a light beam according to any of the claims 1 to 57 whereby said variable attenuation means (VAM) comprises at least one spatial light modulator (SLM).

59. Method for establishing a light beam according to any of the claims 1 to 58 whereby said spatial light modulator (SLM) is of a magneto-optic type.

60. Method for establishing a light beam according to any of the claims 1 to 59 whereby said spatial light modulator (SLM) is of an electro-optic type.

61. Method for establishing a light beam according to any of the claims 1 to 60 whereby said spatial light modulator (SLM) is of an acousto-optic type.

62. Method for establishing a light beam according to any of the claims 1 to 61 whereby said spatial light modulator (SLM) is a liquid crystal display.

63. Method for establishing a light beam according to any of the claims 1 to 62 whereby said spatial light modulator (SLM) is a micro-mechanical shutter array.

64. Method for establishing a light beam according to any of the claims 1 to 63 whereby said spatial light modulator (SLM) is a DMD modulator.

65. Method for establishing a light beam according to any of the claims 1 to 64 whereby said spatial light modulator (SLM) is at least partly controlled by said attenuation control means (ACM).

66. Method for establishing a light beam according to any of the claims 1 to 65 whereby said variable attenuation means (VAM) comprises at least one pivotally mounted mirror (PM) and at least one attenuation filter (AF).

67. Method for establishing a light beam according to any of the claims 1 to 66 whereby said variable attenuation means (VAM) comprises means for changing the direction of said light beam (LB).

68. Method for establishing a light beam according to any of the claims 1 to 67 whereby the luminous intensity of said established light beam with substantially constant luminous intensity (CLB) is completely constant.

69. Method for establishing a light beam according to any of the claims 1 to 68 whereby the luminous intensity of said established light beam with substantially constant luminous intensity (CLB) is constant within a tolerance of ±50%, more preferable within a tolerance of ±10%, and even more preferably within a tolerance of ±1%.

70. Method for establishing a light beam according to any of the claims 1 to 69 whereby the luminous energy conducted by said established light beam with substantially constant luminous intensity CLB during one peaking period is within ±10%, more preferable within ±5%, and even more preferably within ±1%, of the luminous energy conducted during a nominal period.

71. Method for establishing a light beam according to any of the claims 1 to 70 whereby said light source (SAL) is a short arc lamp.

72. Method for establishing a light beam according to any of the claims 1 to 71 whereby said lamp driver (LD) establishes an alternating current with current peaks (CP) for driving said light source (SAL).

73. Method for establishing a light beam according to any of the claims 1 to 72 whereby said lamp driver (LD) establishes a direct current with current peaks (CP) for driving said light source (SAL).

74. Use of the method according to any of the claims 1 to 73 in a light modulating arrangement used for photolithography.

75. Use of the method according to any of the claims 1 to 74 in a light modulating arrangement used for image projection.

76. An apparatus establishing a light beam (CLB) with substantially constant luminous intensity comprising
a light source (SAL) establishing a light beam (LB),
a variable attenuation means (VAM), and
an attenuation control means (ACM);

wherein said light beam is moderated into a light beam (CLB) with substantially constant luminous intensity by means of the method according to any of the claims 1 to 73.